some syntactically pleasing headlines:
Miners Refuse To Work After Death
Enraged Cow Injured Farmer With Axe
Squad Helps Dog Bite Victim
Two Sisters Reunited After 18 Years In Checkout Counter
British Left Waffles On Falkland Islands
Lansing Residents Can Drop Off Trees
Ban On Soliciting Dead In Trotwood
Kids Make Nutritious Snacks
I will tickle the child with the feather
I will tickle the child with the feather

NP --> (Det) (Adj) N (PP)
VP --> V (NP) (PP)
PP --> P (NP)

I will tickle the child
I will tickle the child with the feather
I will tickle the child with the feather

I will tickle the child
I will tickle the child with the feather

IP --> NP I VP
NP --> (Det) (Adj) N (PP)
VP --> V (NP) (PP)
PP --> P (NP)
I will tickle the child **with the feather**

IP --> NP I VP
NP --> (Det) (Adj) N (PP)
VP --> V (NP) (PP)
PP --> P (NP)
I will tickle the child **with the feather**

IP --> NP I VP

NP --> (Det) (Adj) N (PP)

VP --> V (NP) (PP)

PP --> P (NP)
I will tickle the child **with the feather**

I will tickle the c. **with the f.**
I will tickle the child **with the feather**

the child **with the feather**, I will tickle

the child, I will tickle **with the feather**

I will tickle the c. **with the f.**  I will tickle the c. **with the f.**
terminology break:

- Det, N, and PP are *sisters*

I will tickle the c. with the f.
termiology break:

- Det, N, and PP are *sisters*
- NP is the *mother* of Det, N, and PP

I will tickle the c. with the f.
terminology break:

- Det, N, and PP are **sisters**
- NP is the **mother** of Det, N, and PP
- IP **immediately dominates** NP, I, and VP

I will tickle the c. with the f.
terminology break:

- Det, N, and PP are **sisters**
- NP is the **mother** of Det, N, and PP
- IP **immediately dominates** NP, I, and VP
- IP **dominates** NP, I, VP, NP, Det, N…..

I will tickle the c. with the f.
I will tickle the c. with the f.

**terminology break:**

- Det, N, and PP are **sisters**
- NP is the **mother** of Det, N, and PP
- IP **immediately dominates** NP, I, and VP
- IP **dominates** NP, I, VP, NP, Det, N.....
- $\alpha$ is a **constituent** if all and only the words in $\alpha$ are dominated by some node.
terminology break:

- Det, N, and PP are **sisters**
- NP is the **mother** of Det, N, and PP
- IP **immediately dominates** NP, I, and VP
- IP **dominates** NP, I, VP, NP, Det, N....
- $\alpha$ is a **constituent** if all and only the words in $\alpha$ are dominated by some node.
- **triangle**

I will tickle the c. with the f.
splitting the atom further...X' levels

Mary's picture
X' levels

Mary's picture  *the Mary's picture
the   picture   *Mary's the picture
a    picture    *a Mary's picture...
X' levels

Mary's picture  *the Mary's picture
the picture    *Mary's the picture
a picture      *a Mary's picture...

(why does 's require an NP?)
Mary's long book
**X' levels**

```
NP
  /   \\
  DP---AP---N
     /     |
    NP     D
          |
           Mary's long book
```  

**coordination**

I liked Mary's [long book] and [short essays]

**ellipsis**

I liked Mary's [long book] but hated John's [].

*I liked Mary's long book but hated [] sonata.
X' levels

```
NP
  ___
 DP  ???
    /   \
   NP  AP  N
      /  \
     D    \
   Mary's long book
```
X' levels

NP

DP NP?

NP AP N

D

Mary's long book
No: if NP--->DP NP, then:

*Mary's Bob's (....) picture
X' levels

```
NP
  /   
DP   N'
    /   
 NP  AP  N
   /  
  D   
 Mary's long book
```

\[ NP \rightarrow (DP) \ N' \]

\[ N' \rightarrow (AP) \ N \ (PP) \]
X' levels: not just for NP

I [have won the lottery]
I [will never work again]

--> I [have won the lottery] and [will never work again]
X' levels

---> I [have won the lottery] and [will never work again]

I have won the lottery
X' levels

---> I [have won the lottery] and [will never work again]

I

I

I have won the lottery
X' levels
NP-->(DP) N'
N'--> (AP) N (PP)

IP---> NP I'
I'---> I VP
X' levels
NP-->(DP) N'
N'--> (AP) N (PP)

IP--> NP I'
I'--> I VP

XP-->(YP) X'
X'--> (WP) X (ZP)
X-bar schema

XP --> (YP) X'
X' --> (WP) X (ZP)
**X-bar schema**

XP --> (YP) X'

X' --> (WP) X (ZP)

**Diagram:**

```
XP
   / \
  YP   X'
  /    /\  
 X    Z P
```

**Specifier:** (daughter of XP)
X-bar schema

$XP \rightarrow (YP) \ X'$

$X' \rightarrow (WP) \ X \ (ZP)$
X-bar schema
XP--> (YP) X'
X'--> (WP) X (ZP)

VP--> V (NP) (PP)
The ants *thrived*. 
The anteater *arrived*. 
The anteater *devoured* the ants. 
Mary *slapped* the anteater.
X-bar schema
XP---> (YP) X'
X'---> (WP) X (ZP)

VP---> V (NP) (PP)

* The ants **thrived** the ant-farm.
* The anteater **arrived** the house.
* The anteater **devoured**.
* Mary **slapped**.
arrive  /əraɪv/
"get to a place"
V
intransitive (must not have an NP sister)

slap       /slæp/
"strike with the flat of the hand"
V
transitive (must have an NP sister)
selection/subcategorization:
heads get to say what their complements should be.

not just NP....

  The anteater put the ants on the plate.
* The anteater put on the plate.
* The anteater put the ants.
* The anteater put.

-->**put** selects for an NP and a PP.
X-bar schema

XP---> (YP) X'
X'--> (WP) X (ZP)

...with selection filling in some of the gaps.
...but not everything is selected:

the bug
the big bug
the big black bug
the big black flying bug
...but not everything is selected:

the bug
the big bug
the big black bug
the big black flying bug
(orange, anteater... )
...not everything is selected:

the student
the student with blue hair
the student with blue hair in the front row
...not everything is selected:

the student (orange, anteater...)
the student with blue hair
the student with blue hair in the front row
...but some things are selected:

the student of physics
*the orange of physics
*the anteater of physics

the student with blue hair
the orange with blue hair
the anteater with blue hair
X-bar schema
XP --> (YP) X'
X' --> (TP) X' (UP)
X' --> (WP) X (ZP)
X-bar schema

XP --> (YP) X'
X' --> (TP) X' (UP)
X' --> (WP) X (ZP)

NP

DetP

the

N'

N

PP

with blue hair

student

of physics

adjunct
**X-bar schema**

XP --> (YP) X'
X' --> (TP) X' (UP)
X' --> (WP) X (ZP)

**Projection Principle**
All and only **complements** are selected by the head.
X-bar schema

XP --> (YP) X'
X' --> (TP) X' (UP)
X' --> (WP) X (ZP)

the student [with blue hair] [in the front row]
*the student [of physics] [of chemistry]
X-bar schema

XP --> (YP) X'
X' --> (TP) X' (UP)
X' --> (WP) X (ZP)

NP
  ┌── DetP
  │   the
  └── N'
        ┌── N
        │   student
        └── PP [with blue hair]
            ┌── PP of physics
            │   of physics
            └── N'

student [of physics] [with blue hair]
*student [with blue hair] [of physics]
X-bar schema

XP --> (YP) X'
X' --> (TP) X' (UP)
X' --> (WP) X (ZP)

the

N'

student

PP with blue hair

of physics

the [[student of physics]]
and [purveyor of fine chocolates]]
[with blue hair]
The anteater will put the ants into the bowl
*The anteater will put into the bowl
*The anteater will put the ants

-->put selects for an NP and a PP
The anteater will put the ants in the bowl on Tuesday.
I will put the ants in the bowl on Tuesday.
the anteater

specifier of IP (daughter of maximal projection)

complements of V (sisters of the head)

will

put

on Tuesday

in the bowl
I will put the ants in the bowl on Tuesday.

**Specifier** of IP (daughter of maximal projection)

**Adjunct** (daughter of X', sister of X')

**Complements** of V (sisters of the head)
The anteater will put the ants into the bowl
*The anteater will put into the bowl
*The anteater will put the ants

What will the anteater put into the bowl?

-->failure of subcategorization?
The anteater will put **the ants on the plate**
*The anteater will put **on the plate**
*The anteater will put **the ants**

the anteater will put **what on the plate**?
The anteater will put the ants on the plate
*The anteater will put on the plate
*The anteater will put the ants

What will the anteater put ___ on the plate?
actually, two things are moving...

What will the anteater ___ put ___ on the p.?

...and since will is bright blue, let's concentrate on it first.
the anteater will put the ants in the bowl on Tuesday
the anteater

I

will

can

should

V

V

V

V

put

the ants

in the bowl

on Tuesday

IP

NP

VP

PP

IP

I'
The anteater will can put the ants...
The anteater puts the ants...

*The anteater will puts the ants...
The anteater put-Ø the ants...
The anteater placed the ants...
I next to V somehow gets onto V
The anteater will eat ants.
The anteater will eat ants. I wonder [whether the anteater will eat ants] I believe [that the anteater will eat ants]
The anteater will eat ants.

I wonder **whether** the anteater will eat ants

I believe **that** the anteater will eat ants

I believe **that** the anteater will eat ants, I believe.

I believe **that** the anteater will eat ants

and **that** the earth is flat
a new XP: CP

The anteater will eat ants.

I wonder [whether the anteater will eat ants]
I believe [that the anteater will eat ants]

*I wonder [that the anteater will eat ants]*
*I believe [whether the anteater will eat ants]*
I believe [that the anteater will eat ants]
I believe [that the anteater will eat ants]
I believe [that the anteater will eat ants]
Wendolene realized that Wallace liked cheddar cheese in the bathtub.
Wendolene realized that Wallace liked cheddar cheese in the bathtub.
Wendolene realized that Wallace liked cheddar cheese in the bathtub.
Wendolene realized that Wallace liked cheddar cheese in the bathtub.
Wendolene realized that Wallace liked cheddar cheese in the bathtub.
Wendolene realized that Wallace liked cheddar cheese in the bathtub in the swimming pool.
Wendolene realized that Wallace liked cheddar cheese in the bathtub in the swimming pool.
Wendolene realized that Wallace liked cheddar cheese in the bathtub in the swimming pool.
**English, Japanese:**

**VP:**

```
  VP
  /  
V'  
  /  
 NP  
  /  
 V   
```

John [ate nattoo].
**English, Japanese:**

**VP:**

```
  VP
   |
 VP
 |
 V'
 |
  NP
 |
  V
```

John [ate nattoo].

```
  VP
   |
 VP
 |
 V'
 |
  NP
 |
  V
```

John-wa [nattoo-o tabeta].
**English, Japanese:**

**VP:**

\[
\begin{array}{ccc}
V & NP & \quad & NP & V \\
John [ate nattoo]. & & John-wa [nattoo-o tabeta].
\end{array}
\]

**PP:**

\[
\begin{array}{ccc}
PP & & PP \\
PP & & P' \\
P' & & NP \\
P & & \\
\end{array}
\]

Mary went [to Tokyo].
**English, Japanese:**

**VP:**

\[
\text{V} \quad \text{NP} \quad \text{NP} \quad \text{V}
\]

John [ate nattoo].

\[
\text{NP} \quad \text{V}
\]

John-wa [nattoo-o tabeta].

**PP:**

\[
\text{PP} \\
\quad \text{P'} \\
\quad \quad \text{NP} \\
\quad \quad \quad \text{P}
\]

Mary went [to Tokyo].

\[
\text{PP} \\
\quad \text{P'} \\
\quad \quad \text{NP} \\
\quad \quad \quad \text{P}
\]

Mary-wa [Tookyoo e] itta.
English, Japanese:

**VP:**

\[
\begin{align*}
V & \quad NP \\
\text{John [ate nattoo].} & \quad \text{John-wa [nattoo-o tabeta].}
\end{align*}
\]

**PP:**

\[
\begin{align*}
P & \quad NP \\
\text{Mary went [to Tokyo].} & \quad \text{Mary-wa [Tookyoo e] itta.}
\end{align*}
\]

**CP:**

\[
\begin{align*}
\text{CP} \\
\quad \text{C'} \\
\quad \text{IP} \\
\quad \text{C}
\end{align*}
\]

\[
\text{Bill thinks [that nattoo is tasty].}
\]
**English, Japanese:**

**VP:**

John [ate nattoo].

John-wa [nattoo-o tabeta].

**PP:**

Mary went [to Tokyo].

Mary-wa [Tookyoo e] itta.

**CP:**

Bill thinks [that nattoo is tasty].

Bill-wa [nattoo-ga oishii to] omou.
**English, Japanese:**

**VP:**

\[
\begin{align*}
& V \quad NP \\
& \text{John [ate nattoo].} \\
& NP \quad V \\
& \text{John-wa [nattoo-o tabeta].}
\end{align*}
\]

**PP:**

\[
\begin{align*}
& P \quad NP \\
& \text{Mary went [to Tokyo].} \\
& NP \quad P \\
& \text{Mary-wa [Tookyoo e] itta.}
\end{align*}
\]

**CP:**

\[
\begin{align*}
& C \quad IP \\
& \text{Bill thinks [that nattoo is tasty].} \\
& IP \quad C \\
& \text{Bill-wa [nattoo-ga oishii to] omou.}
\end{align*}
\]

**heads precede complements**

**heads follow complements**
Head direction parameter:
Heads \{precede, follow\} their complements.

**English:** SVO

**Japanese:** SOV
Head direction parameter:
Heads \{precede, follow\} their complements.

**English: SVO**

- **John**
- **ate**
- **the nattoo**

**Japanese: SOV**

- **John-wa**
- **tabeta**
- **nattoo-o**
**Head-final languages:**

**VP:**

\[
\text{NP} \quad \text{V}
\]

John-wa [nattoo-o tabeta]. 'John ate nattoo' (*Japanese*)

Bkrashis-lags-gi [shabagleb mchodpared] 'Tashi ate shabagleb' (*Tibetan*)

Maana [moosat nopna] 'The girl fed the cat' (*Hopi*)

**PP:**

\[
\text{NP} \quad \text{P}
\]

Mary-wa [ Tookyoo e] itta. 'Mary went to Tokyo' (*Japanese*)

Bkrashish-lags-gi [Lhasa la] phebspared. 'Tashi went to Lhasa' (*Tibetan*)

Moosa [maanat aw] wayma. 'The cat walks toward the girl' (*Hopi*)
Head-initial languages:

VP:

\[ V \quad NP \]

John [ate hamburgers]
[kumain ng itlog ] ang lalaki 'The man ate an egg' (Tagalog)
[nilikuta kitabu] 'I found the book' (Swahili)

PP:

\[ P \quad NP \]

Mary went [to Boston]
Pumunta [sa Maynila] si Maria 'Mary went to Manila' (Tagalog)
alitembea [mpaka Dar] 'He walked to Dar' (Swahili)
Languages don't just differ without limit; there are patterns. Head-final/head-initial is one of the typical patterns.

(though, to be honest.....)
Back to English:

The anteater will put ants in the jar.
*The anteater will put in the jar.
*The anteater will put ants.

I don't know
[what the anteater will put in the jar].

```
  IP
   NP
      the anteater
   I' will
       VP
          V' put
             V
                NP
                    what
             PP
                    in the jar
```
the anteater will put what in the jar
"wh-movement"

I will put what in the jar.
Surface Structure

NP

C

NP

I'

the anteater

I

will

V'

V

put

PP

in the jar
One reason to think that *what* moves into CP:

I don't know [**whether** he ate the ants]
I think       [**that** he ate the ants]

I don't know [**what** he ate]
*I don't know [**what** **that** he ate]
*I don't know [**what** **whether** he ate]
One reason to think that *what* moves into CP:

**Irish**
Bíonn fios agat i gconaí [**go** bhuailfidh an píobaire an t-amhrán] be know at-you always **C** will-play the piper the song 'You always know that the piper will play the song'

Bíonn fios agat i gconaí [caidé **a** bhuailfidh an píobaire __ ] be know at-you always what **C** will-play the piper 'You always know what the piper will play'
One reason to think that *what* starts out as the complement of the verb: **West Ulster English**

*What all* did you give ___ to the kids?  
*What* did you give ___ *all* to the kids?  

*Who all* did you send ___ to the shops?  
*Who* did you send ___ *all* to the shops?  

*What all* did you do ___ after school today?  
*What* did you do ___ *all* after school today?  
*What* did you do ___ after school today *all*?
Head-movement

What will the anteater put in the jar?
I will put what in the jar.
Deep Structure
the anteater will put what in the jar

Wh-movement
the anteater will put what in the jar

Head-movement
what the anteater will put ___ in the jar

Surface Structure
what will the anteater __ put ___ in the jar
The anteater will put ants in the jar.  
Will the anteater put ants in the jar?
The anteater will put ants in the jar.

Will the anteater put ants in the jar?

The anteater \(-s\) \textbf{put} ants in the jar.

\[\rightarrow\text{the anteater} \ \textbf{puts} \ \text{ants in the jar.}\]

\[-s\] the anteater \textbf{put} ants in the jar?

\[\downarrow\]

\textbf{does} the anteater \textbf{put} ants in the jar? \quad "\textbf{do-support}"
The anteater will put ants in the jar.

Will the anteater put ants in the jar?

The anteater -s put ants in the jar.

-→ the anteater puts ants in the jar.

-s the anteater put ants in the jar?

does the anteater put ants in the jar?

The anteater -d place ants in the jar.

-→ The anteater placed ants in the jar.

-d the anteater place ants in the jar?

did the anteater place ants in the jar?
The anteater **-d place** ants in the jar.
→ The anteater **placed** ants in the jar.

**-d**

the anteater place ants in the jar?

**did**

the anteater place ants in the jar?

The anteater **-d put** ants in the jar.
The anteater **put** ants in the jar.

**-d**

the anteater put ants in the jar?

**did**

the anteater put ants in the jar?

- I adjacent to the V attaches to the verb...
  if it's not adjacent to the V, you get *do*-support.
I don't know...

[...what the anteater will put in the jar]
"wh-movement" transformation

I will put *what* in the jar

the anteater
Surface Structure

[Diagram of a tree structure representing the sentence: "what the anteater will put in the jar"]
Head direction parameter:
Heads \{precede, follow\} their complements.
Head direction parameter:
Heads \{precede, follow\} their complements.

**English: SVO**

```
IP
  NP
  John
  (-ed)
  I
  VP
    V'
    V
    ate
  NP
  the nattoo
```

**Japanese: SOV**

```
IP
  NP
  John-wa
  VP
    V'
    V
    tabeta
  I
  nattoo-o
```
Head direction parameter:
Heads \{precede, follow\} their complements.

English: SVO

Japanese: SOV
Notice that there is no "specifier direction parameter".
**English: SVO**

**Japanese: SOV**
"The Klingon ate the qaH"
Here on Earth, OVS languages are extremely rare (though there are a few apparent examples):

*Hixkaryana*

Kuraha yonyhoryeno bïye komo

*bow  made  boy*

'The boy made a bow'
specifiers are always on the left.

There is a "head direction parameter", but no "specifier direction parameter".

This has consequences for acquisition....
wh-movement again

\[
\textbf{What} \text{ did you put } \_\_ \text{ on the table?}
\]

\[
\textbf{Ano } \text{ ang inilagay mo } \_\_ \text{ sa lamesa?} \quad [\text{Tagalog}]
\]

\text{what put you on table}

\[
\textbf{Mihin } \text{ panen vaatteeni } \_\_ \text{?} \quad [\text{Finnish}]
\]

\text{where I-put my-clothes}
**wh-in-situ**

Zhangsan mai-le **shenmo**?  
Zhangsan bought what  
‘What did Zhangsan buy?’

Suu ki yuu **ako**?  
Suu TNS buy what  
‘What did Suu buy?’

Ya um **hakiy** tuwa?  
Q you who-ACC found  
‘Who did you find?’
multiple-wh

What did you give ___ to whom?
multiple-wh

**What** did you give **__** to **whom**?

Kakvo na kogo e dal **__ __**?  \[Bulgarian\]
what to whom he-gave

Takhróri ñuhka náhóta **__** wa'ehnínu' **__**  \[Mohawk\]
tell-me who what bought
'Tell me who bought what.'
wh-review:

• wh-movement is to the left.

• languages move zero, one, or all wh-phrases.
wh-review:

• wh-movement is to the left.
  (specifiers are always on the left)

• languages move zero, one, or all wh-phrases.
wh-review:

- wh-movement is to the left.
  (specifiers are always on the left)

- languages move zero, one, or all wh-phrases.
  (language cannot count)
some imaginable but unattested languages:

• wh-movement to the right

  __ bought the mango **who**?

• movement of up to two wh-phrases

  **who** **what** __ gave __ to **whom**?
Logical problem of language acquisition

\[ f(1) = 1 \]
\[ f(2) = 2 \]
\[ f(3) = 3 \]
\[ f(4) = 4 \]
\[ f(5) = ?? \]
Logical problem of language acquisition

\[ f(1) = 1 \]
\[ f(2) = 2 \]
\[ f(3) = 3 \]
\[ f(4) = 4 \]
\[ f(5) = 29 \]

\[ f(n) = (n-1)(n-2)(n-3)(n-4) + n \]
acquisition of wh-strategies

Kakvo na kogo e dal __ __? [Bulgarian]
what to whom he-gave
'What did he give to whom?'
acquisition of wh-strategies

Kakvo na kogo e dal ___?  [Bulgarian]
what to whom he-gave
'What did he give to whom?'

- move all wh-phrases?
- move two wh-phrases?
- move up to three wh-phrases?
- move up to four wh-phrases?
...

acquisition of wh-strategies

Kakvo na kogo e dal ___? [Bulgarian]
what to whom he-gave
'What did he give to whom?'

- move all wh-phrases
- move two wh-phrases?
- move up to three wh-phrases?
- move up to four wh-phrases?
...

acquisition of wh-strategies

Zhangsan mai-le shenmo? [Chinese]
Zhangsan bought what
‘What did Zhangsan buy?’
acquisition of wh-strategies

Zhangsan mai-le shenmo? [Chinese]
Zhangsan bought what
‘What did Zhangsan buy?’

• wh-in-situ?
• move wh-phrase to the right?
• make wh-phrase the third word?
    ....
acquisition of wh-strategies

Zhangsan mai-le shenmo? [Chinese]
Zhangsan bought what
‘What did Zhangsan buy?’

• wh-in-situ
• move wh-phrase to the right?
• make wh-phrase the third word?

....